

Application No.: 10/722,177

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REMARKS

Claims 1-21 are pending.

The present disclosure relates to coating solutions comprising surface-modified nanoparticles. (Page 1, lines 9-10.) The present inventors have discovered that the addition of surface-modified nanoparticles to certain coating solutions can inhibit defect formation without adversely impacting the coating and drying processes, as can occur with prior art methods of reducing coating defects. (See, e.g., page 1, line 29 – page 2, line 5; and page 4, lines 28-31.)

In one aspect, the pending claims provide coating solutions comprising surface-modified nanoparticles; a first liquid having a vapor pressure, VP1; and a second liquid miscible with the first liquid, having a vapor pressure, VP2. The vapor pressure of the second liquid is less than the vapor pressure of the first liquid (i.e.,  $VP2 < VP1$ ). Also, the nanoparticles are more compatible with the first liquid than with the second liquid. (See, e.g., independent claim 1.)

In another aspect, the pending claims provide methods of enhancing coating uniformity. The methods comprise applying a coating solution to the surface of a substrate, wherein the coating solution comprises surface-modified nanoparticles; a first liquid having a vapor pressure, VP1; and a second liquid miscible with the first liquid, having a vapor pressure, VP2, that is less than VP1, wherein the nanoparticles are more compatible with the first liquid than with the second liquid. (See, e.g., claim 13.)

§ 103 Rejections

Claims 1-21 stand rejected under 35 USC § 103(a) as being unpatentable over Ducoffre et al. (US Patent No. 6,649,672) in view of Houlihan et al. (US Patent No. 6,700,708).

According to Ducoffre et al., compatibility problems can occur when nanoparticles are incorporated into lacquer systems. (Col. 1, lines 21-29.) Ducoffre et al. purport to solve this problem by “by reaction of carboxyl-functional nanoparticles with epoxy-functional binders to give lacquer binders modified with nanoparticles.” (Col. 1, lines 32-34.) Applicants respectfully submit that the present claims, which require surface modified nanoparticles exhibiting a differential in compatibility with two liquid present in the coating composition (see, e.g., claim

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1), are patentably distinct from the system of Ducoffre et al. wherein the surface modified nanoparticles are reacted with one of the components to avoid incompatibility problems.

The concept of "compatibility" as used in the present application is described at page 7, line 21 – page 8, line 9. Specifically, compatibility can be assessed by measuring the viscosity build in a "mixture of the liquid with increasing amounts (percent by weight) of nanoparticles." (Emphasis added.) Applicants respectfully submit that the Patent Office has failed to show how Ducoffre et al. describe, teach, or suggest a mixture including surface modified nanoparticles such that one of ordinary skill in the art would consider the particles as having a "compatibility" with a material, as opposed to being "reacted" with that material.

Applicants note that, in Example 5, Ducoffre et al. attempted to incorporate the surface modified nanoparticles into a coating solution without reacting the particles with the epoxy binder. However, according to Ducoffre et al., this attempt failed, as incompatibility phenomena occurred. (Col. 8, lines 16-20.)

In summary, Ducoffre et al. require the reaction of epoxy-functional binders with reactive carboxyl surface-modifying groups on the nanoparticles. (See, e.g., col. 1, lines 30-31.) In contrast, the present invention requires surface-modified nanoparticles having a differential in compatibility between a first liquid having a higher vapor pressure and a second liquid having a lower vapor pressure. (See, e.g., claim 1.)

According to the Patent Office, it would be obvious to use the 1-methoxy-2-propanol acetate of Houlihan et al. as the solvent for the nanoparticle-containing epoxy resin compositions of Ducoffre et al. First, as discussed above, the Patent Office has failed to show how Ducoffre et al. describe, teach, or suggest a mixture of nanoparticles and an epoxy resin rather than the reaction of nanoparticles with the resin. Thus, even if one of ordinary skill in the art were motivated to use the solvent of Houlihan et al. in the system of Ducoffre et al., the combination would still fail to teach all elements of the claimed invention.

Second, according to Houlihan et al. "If the epoxy is to be filled with nanoparticles, the uncured resin must have good solubility in a solvent ... which can be used to mix in the commercially available nanoparticle colloidal suspension without breaking the suspension." (See col. 4, lines 30-35, emphasis added.) Houlihan et al. further note that an ideal solvent "should be able to maintain the colloidal suspension" and that "if the epoxy is filed with

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nanoparticles, it should be able to retain a suspension of particles.” (See col. 4, lines 35-45, emphasis added.) Thus, Houlihan et al. is expressly directed toward a mixture or suspension of nanoparticles with an uncured epoxy resin and a solvent.

Ducoffre et al. expressly state that their object is to eliminate or largely avoid incompatibility problems in lacquer systems containing nanoparticles. According to Ducoffre et al., this object is achieved by reaction of the nanoparticles with the epoxy-function binders. (See col. 1, lines 30-38.) Thus, Ducoffre et al. teach away from the very composition the Patent Office is proposing by combining Houlihan et al. with Ducoffre et al., i.e., a suspension or mixture of particles with the resin and a solvent. (See also Example 5, wherein unreacted nanoparticles and epoxy-functional resin were combined and incompatibility phenomena occurred.)

In summary, Applicants respectfully submit that the Patent Office’s proposed motivation to combine the references is in conflict with the express teachings of Ducoffre et al. Furthermore, even if proper motivation existed, the resulting combination fails to teach all elements of the claimed invention.

For at least these reasons, the rejection of claims 1-21 under 35 USC § 103(a) as purportedly being unpatentable over Ducoffre et al. (US Patent No. 6,649,672) in view of Houlihan et al. (US Patent No. 6,700,708) is unwarranted and should be withdrawn.

In view of the above, it is submitted that the application is in condition for allowance. Reconsideration of the application is requested and allowance of claims 1-21 at an early date is solicited.

Respectfully submitted,

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Date

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